

CLAIMS

1. An image display device comprising:
 - a display portion that projects, via eyepiece optical systems which respectively
 - 5 correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam emitting direction onto the eyeballs of said user;
 - a supporting portion that supports said display portion at its portion that is not in contact with said user; and
 - 10 a face contact portion that is supported by said display portion, is provided in contact with the face sides of said user, sandwiches the face of said user, and is capable of changing the distance between said eyepiece optical systems and the eyes of said user.
2. An image display device according to claim 1, wherein said display portion is
- 15 movable in accordance with the movement of the head of said user and with the distance between said eyepiece optical systems and the eyes of said user, a portion of said face contact portion being a point of support.
3. An image display device according to claim 1 or 2,
 - wherein said face contact portion comes into contact with the face sides by
 - 20 sandwiching the both ears of said user, and
 - wherein the portion sandwiching said both ears comprises a sound output mechanism.
4. An image display device according to any one of claims 1-3,
 - wherein said face contact portion comprises an elastic member for coming into
 - 25 contact with the face sides of said user, and
 - wherein said face contact portion comprises, independently of said elastic member, a width changing portion that changes the face sandwiching width and a distance changing portion that changes the distance between said eyepiece optical systems and the eyes of said user.
- 30 5. An image display device according to any one of claims 1-4, wherein said display portion changes, in accordance with the distance between said eyepiece optical systems and the eyes of said user, the size of an image to be displayed.
6. An image display device according to any one of claims 1-5,
 - wherein said display portion comprises a face fixing member in a portion that
 - 35 faces the front side of the face of said user, and
 - wherein said face contact portion can change its position to a distance where the

front side of the face of said user is in contact with said face fixing member and to a distance where without the front side of the face of said user being in contact with said face fixing members, the sight line of the both eyes of said user is, relative to said display portion, relatively movable around the axis passing through the both ears.

- 5 7. An image display device according to claim 6,
 wherein said display portion comprises said face fixing members in a manner that they, evading the eyeglass frame of said user, are discretely provided around and above and below said both eyes, and

 wherein said display portion comprises light-shielding members for shielding
10 light from the outside in the right-and-left outsides of said eyeglass frame.

8. An image display device according to claim 6 or 7,
 wherein said display portion comprises a frame recognition portion that recognizes whether there exists an eyeglass frame of said user, and

 wherein the thickness in the optical axis direction of said eyepiece optical
15 systems is changeable in accordance with the recognition results by said frame recognition portion.

9. An image display device according to any one of claims 1-8, wherein each of said eyepiece optical systems in said display portion is constituted by at least three pieces of lenses.

20 10. An image display device according to any one of claims 1-9, wherein in each of said eyepiece optical systems in said display portion, the lens located most distant from said eye is constituted by a cemented lens.

11. An image display device according to any one of claims 1-10, wherein in each of said eyepiece optical systems in said display portion, the lens located nearest to said
25 eye is constituted by a lens of which at least one surface is a conic surface with conic constant $K < 0$.

12. An image display device according to any one of claims 1-11,
 wherein said display portion comprises relay optical systems and light diffusing plates between said photoelectric device and said eyepiece optical systems, and

30 wherein the transmitted images of said light diffusing plates are projected, via said eyepiece optical systems, onto the eyeballs of said user.

13. An image display device according to any one of claims 1-12,
 wherein said supporting portion comprises a balance portion that cancels the moment of said display portion relative to said supporting portion, and

35 wherein said supporting portion comprises a hardwiring for connecting said display portion to the outside, said hardwiring being provided along the inside of said

supporting portion, a portion of said display portion fixed to a portion of said balance portion.

14. An image display device according to claim 1, wherein said supporting portion is expandable and contractible.

5 15. An image display device according to claim 14, further comprising:
a setting condition detection portion that detects the setting condition; and
a supporting portion control portion that suppresses the expansion and contraction changes of said supporting portion when said setting condition detection portion detects that the setting condition has significantly deteriorated.

10 16. An image display device according to claim 1, further comprising:
an adjustment portion which is provided on a portion of said supporting portion and which adjusts at least either the setting angle of said supporting portion relative to a floor portion or the setting angle of said display portion relative to said floor portion.

15 17. An image display device according to claim 16, wherein said supporting portion comprises a vertical balance portion having a weight.

18. An image display device according to claim 1,
wherein said display portion can change the content of the center region in the projection area and the content of the peripheral region in the projection area when said display portion displays said image, and

20 wherein said display portion performs either a first display in which said image is projected with a high-definition in said center region and said image is projected with a low-definition in said peripheral region or a second display in which the entirety of said image is projected with a high-definition in said center region and an image different from said image is projected with a low-definition in said peripheral region.

25 19. An image display device according to claim 18, wherein when said display portion performs said second display, said display portion displays an image different from said image in the portion of said photoelectric device corresponding to said peripheral region.

30 20. An image display device according to claim 19, wherein when said display portion performs said second display, said display portion displays an image having predetermined patterns of which sizes become smaller as they near said center region in the portion of said photoelectric device corresponding to said peripheral region.

35 21. An image display device according to claim 20, wherein when said display portion performs said second display, said display portion displays, in the portion of said photoelectric device corresponding to said center region, an image having in at least a portion of the periphery of the portion of said photoelectric device corresponding

to said center region said predetermined patterns that are similar to and smaller than said predetermined patterns.

22. An image display device according to claim 21, wherein when said display portion performs said second display, said display portion projects said image in a defocused condition in said peripheral region.

23. An image display device according to any one of claims 18-22, wherein said face contact portion comprises a movement detection portion that detects the movement of the face of said user, and

wherein said display portion shifts the display region of the image to be displayed on said photoelectric device in the portion of said photoelectric device corresponding to said center region, in accordance with the movement of the face of said user detected by said movement detection portion.

24. An image display device according to claim 18, wherein when said display portion performs said second display, said display portion displays information relating to the operation by said user as an image different from said image in the portion of said photoelectric device corresponding to said peripheral region.

25. An image display device according to claim 18 or 24, wherein said face contact portion comprises a movement detection portion that detects the movement of the face of said user, and

wherein said display portion shifts either the display region of the image to be displayed on said photoelectric device in the portion of said photoelectric device corresponding to said center region or the display region where the information relating to the operation by said user is displayed, in accordance with the movement of the face of said user detected by said movement detection portion.

26. An image display device according to claim 1, comprising:
an information recording portion that records information relating to said user;
and

a control portion which reads out the information relating to said user recorded in said information recording portion and, based on the information, controls said display portion and said face contact portion.

27. An image display system comprising:

a display portion that projects, via eyepiece optical systems which respectively correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam emitting direction onto the eyeballs of said user;

a chair portion on which said user can sit and of which backrest portion is

reclinable;

a supporting portion which is united with said chair portion and which supports said display portion at its portion that is not in contact with said user; and

5 a face contact portion which is supported by said display portion and comes into contact with the face of said user,

wherein said supporting portion is movable so that said display portion follows the head of said user in accordance with the inclination of the backrest portion of said chair portion.

28. An image display system according to claim 27,

10 wherein said face contact portion is provided in contact with the face sides of said user and sandwiches the face of said user, and

wherein said display portion is movable in accordance with the movement of the head of said user, a portion of said face contact portion being a point of support.

29. An image display system according to claim 27 or 28,

15 wherein said supporting portion comprises a balance portion that cancels the moment of said display portion relative to said supporting portion.

30. An image display system according to any one of claims 27-29, wherein said supporting portion comprises a string-like flexible member that connects said display portion and said balance portion and a friction relaxing mechanism that relaxes the
20 friction occurring to said flexible member.

31. An image display system according to claim 30, wherein said supporting portion comprises a stainless-steel fiber as said string-like flexible member.

32. An image display system according to claim 30, wherein said supporting portion comprises a para-type aramid fiber as said string-like flexible member.

25 33. An image display system according to claim 30, wherein said supporting portion comprises a drop prevention mechanism that prevents said display portion from dropping when said flexible member breaks.

34. An image display system according to claim 30, wherein said supporting portion comprises a cover that covers the surface of the supporting portion.

30 35. An image display system according to claim 30, comprising a hardwiring for connecting said display portion to the outside in the inside of said supporting portion, said hardwiring being provided along said string-like flexible member, a portion of said display portion fixed to a portion of said balance portion.

35 36. An image display system according to any one of claims 27-29, wherein said supporting portion comprises a weight in said balance portion, wherein said supporting portion comprises a supporting column,

wherein said supporting column supports said display portion and said weight by suspending them in a manner of a balance, and

wherein when assuming that the weight of said display portion is M , that the weight of said weight is m , that the distance between said display portion and a fulcrum is L , and that the distance between said weight and said fulcrum is l , said supporting column holds said fulcrum at a position where $M \cdot L = m \cdot l$ is satisfied.

37. An image display system according to any one of claims 27-36,

wherein said supporting portion is disposed adjacent to said backrest portion of said chair portion, and

wherein said chair portion comprises a parallel link member which keeps the inclination of said supporting portion relative to the ground in the vertical direction, when said backrest portion inclines.

38. An image display system according to any one of claims 27-37, wherein when said user detaches said display portion from the face, said supporting portion evacuates said display portion out of the region defined by the arc drawn by said head at its center being the hips of said user.

39. An image display system according to claim 27, wherein said supporting portion is expandable and contractible.

40. An image display system according to claim 39, further comprising:
a setting condition detection portion that detects the setting condition; and
a supporting portion control portion that suppresses the expansion and contraction changes of said supporting portion when said setting condition detection portion detects that the setting condition has significantly deteriorated.

41. An image display system according to claim 27, further comprising:
an adjustment portion which is provided on a portion of said supporting portion and which adjusts at least either the setting angle of said supporting portion relative to a floor portion or the setting angle of said display portion relative to said floor portion.

42. An image display system according to claim 41, wherein said supporting portion comprises a vertical balance portion having a weight.

43. An image display system according to claim 27,
wherein said display portion can change the content of the center region in the projection area and the content of the peripheral region in the projection area when said display portion displays said image, and

wherein said display portion performs either a first display in which said image is projected with a high-definition in said center region and said image is projected with a low-definition in said peripheral region or a second display in which the entirety of

said image is projected with a high-definition in said center region and an image different from said image is projected with a low-definition in said peripheral region.

44. An image display system according to claim 43, wherein when said display portion performs said second display, said display portion displays an image different
5 from said image in the portion of said photoelectric device corresponding to said peripheral region.

45. An image display system according to claim 44, wherein when said display portion performs said second display, said display portion displays an image having predetermined patterns of which sizes become smaller as they near said center region in
10 the portion of said photoelectric device corresponding to said peripheral region.

46. An image display system according to claim 45, when said display portion performs said second display, said display portion displays, in the portion of said photoelectric device corresponding to said center region, an image having in at least a portion of the periphery of the portion of said photoelectric device corresponding to said
15 center region said predetermined patterns that are similar to and smaller than said predetermined patterns.

47. An image display system according to claim 46, wherein when said display portion performs said second display, said display portion projects said image in a defocused condition in said peripheral region.

20 48. An image display system according to any one of claims 43-47,
wherein said face contact portion comprises a movement detection portion that detects the movement of the face of said user, and
wherein said display portion shifts the display region of the image to be displayed on said photoelectric device in the portion of said photoelectric device
25 corresponding to said center region, in accordance with the movement of the face of said user detected by said movement detection portion.

49. An image display system according to claim 43, wherein when said display portion performs said second display, said display portion displays information relating to the operation by said user as an image different from said image in the portion of said
30 photoelectric device corresponding to said peripheral region.

50. An image display system according to claim 43 or 49,
wherein said face contact portion comprises a movement detection portion that detects the movement of the face of said user, and
wherein said display portion shifts either the display region of the image to be
35 displayed on said photoelectric device in the portion of said photoelectric device corresponding to said center region or the display region where the information relating

to the operation by said user is displayed, in accordance with the movement of the face of said user detected by said movement detection portion.

51. An image display system according to claim 27, comprising:

an information recording portion that records information relating to said user;
5 and

a control portion which reads out the information relating to said user recorded in said information recording portion and, based on the information, controls said display portion and said face contact portion.

52. An image display system according to claim 27, further comprising:

10 a sound output portion which is disposed in the backrest portion of said chair portion and outputs sound information to said user; and

a vibration portion which is disposed in said chair portion and vibrates in concert with at least one of said image and said sound information.

53. An image display device comprising:

15 a display portion that projects, via eyepiece optical systems which respectively correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam emitting direction onto the eyeballs of said user;

a supporting portion supporting said display portion at its portion that is not in
20 contact with said user and having a balance portion that cancels the moment of said display portion relative to said supporting portion;

a face contact portion supported by said display portion and coming into contact with the face of said user; and

a hardwiring for connecting said display portion to the outside, said hardwiring
25 being provided along the inside of said supporting portion, a portion of said display portion fixed to a portion of said balance portion.

54. An image display device according to claim 53,

wherein said face contact portion is provided in contact with the face sides of said user and sandwiches the face of said user, and

30 wherein said display portion is movable in accordance with the movement of the head of said user, a portion of said face contact portion being a point of support.

55. An image display device comprising:

a display portion that projects, via eyepiece optical systems which respectively correspond to each of the both eyes of a user, a light emitted from a two-dimensionally
35 light emitting type photoelectric device which is perpendicular to the light beam emitting direction onto the eyeballs of said user;

a supporting portion that supports said display portion at its portion that is not in contact with said user; and

a face contact portion that is supported by said display portion and comes into contact with the face of said user,

5 wherein said supporting portion is expandable and contractible.

56. An image display device according to claim 55, further comprising:

a setting condition detection portion that detects the setting condition; and

a supporting portion control portion that suppresses the expansion and contraction changes of said supporting portion when said setting condition detection
10 portion detects that the setting condition has significantly deteriorated.

57. An image display device according to claim 55 or 56,

wherein said face contact portion is provided in contact with the face sides of said user and sandwiches the face of said user, and

wherein said display portion is movable in accordance with the movement of the
15 head of said user, a portion of said face contact portion being a point of support.

58. An image display device comprising:

a display portion that projects, via eyepiece optical systems which respectively correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam
20 emitting direction onto the eyeballs of said user;

a supporting portion that supports said display portion at its portion that is not in contact with said user;

a face contact portion that is supported by said display portion and comes into contact with the face of said user; and

25 an adjustment portion which is provided on a portion of said supporting portion and which adjusts at least either the setting angle of said supporting portion relative to a floor portion or the setting angle of said display portion relative to said floor portion.

59. An image display device according to claim 58, wherein said supporting portion comprises a vertical balance portion having a weight.

30 60. An image display device according to claim 58 or 59,

wherein said face contact portion is provided in contact with the face sides of said user and sandwiches the face of said user, and

wherein said display portion is movable in accordance with the movement of the head of said user, a portion of said face contact portion being a point of support.

35 61. An image display device comprising:

a display portion that projects, via eyepiece optical systems which respectively

correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam emitting direction onto the eyeballs of said user;

5 a supporting portion that supports said display portion at its portion that is not in contact with said user; and

a face contact portion that is supported by said display portion and comes into contact with the face of said user,

10 wherein said display portion can change the content of the center region in the projection area and the content of the peripheral region in the projection area when said display portion displays said image, and

wherein said display portion performs either a first display in which said image is projected with a high-definition in said center region and said image is projected with a low-definition in said peripheral region or a second display in which the entirety of said image is projected with a high-definition in said center region and an image different from said image is projected with a low-definition in said peripheral region.

15 62. An image display device according to claim 61, wherein when said display portion performs said second display, said display portion displays an image different from said image in the portion of said photoelectric device corresponding to said peripheral region.

20 63. An image display device according to claim 62, wherein when said display portion performs said second display, said display portion displays an image having predetermined patterns of which sizes become smaller as they near said center region in the portion of said photoelectric device corresponding to said peripheral region.

25 64. An image display device according to claim 63, wherein when said display portion performs said second display, said display portion displays, in the portion of said photoelectric device corresponding to said center region, an image having in at least a portion of the periphery of the portion of said photoelectric device corresponding to said center region said predetermined patterns that are similar to and smaller than said predetermined patterns.

30 65. An image display device according to claim 64, wherein when said display portion performs said second display, said display portion projects said image in a defocused condition in said peripheral region.

35 66. An image display device according to any one of claims 61-65, wherein said face contact portion comprises a movement detection portion that detects the movement of the face of said user, and

wherein said display portion shifts the display region of the image to be

displayed on said photoelectric device in the portion of said photoelectric device corresponding to said center region, in accordance with the movement of the face of said user detected by said movement detection portion.

5 67. An image display device according to claim 61, wherein when said display portion performs said second display, said display portion displays information relating to the operation by said user as an image different from said image in the portion of said photoelectric device corresponding to said peripheral region.

68. An image display device according to claim 61 or 67,
wherein said face contact portion comprises a movement detection portion that
10 detects the movement of the face of said user, and
wherein said display portion shifts either the display region of the image to be displayed on said photoelectric device in the portion of said photoelectric device corresponding to said center region or the display region where the information relating to the operation by said user is displayed, in accordance with the movement of the face
15 of said user detected by said movement detection portion.

69. An image display device according to any one of claims 61-68,
wherein said face contact portion is provided in contact with the face sides of said user and sandwiches the face of said user, and
wherein said display portion is movable in accordance with the movement of the
20 head of said user, a portion of said face contact portion being a point of support.

70. An image display device comprising:
a display portion that projects, via eyepiece optical systems which respectively correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam
25 emitting direction onto the eyeballs of said user;

a face contact portion that is supported by said display portion and comes into contact with the face of said user;

an information recording portion that records information relating to said user;
and

30 a control portion which reads out the information relating to said user recorded in said information recording portion and, based on the information, controls said display portion and said face contact portion.

71. An image display device according to claim 70,
wherein said face contact portion is provided in contact with the face sides of
35 said user and sandwiches the face of said user, and
wherein said display portion is movable in accordance with the movement of the

head of said user, a portion of said face contact portion being a point of support.

72. An image display system comprising:

a display portion that projects, via eyepiece optical systems which respectively correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam emitting direction onto the eyeballs of said user;

a chair portion on which said user can sit and of which backrest portion is reclinable;

a supporting portion which is united with said chair portion and which supports said display portion at its portion that is not in contact with said user;

a face contact portion which is supported by said display portion and comes into contact with the face of said user;

a sound output portion which is disposed in the backrest portion of said chair portion and outputs sound information to said user; and

a vibration portion which is disposed in said chair portion and vibrates in concert with at least one of said image and said sound information,

wherein said supporting portion is movable so that said display portion follows the head of said user in accordance with the inclination of the backrest portion of said chair portion.

73. An image display system according to claim 72,

wherein said face contact portion is provided in contact with the face sides of said user and sandwiches the face of said user, and

wherein said display portion is movable in accordance with the movement of the head of said user, a portion of said face contact portion being a point of support.

74. An image display device comprising:

a display portion that projects, via eyepiece optical systems which respectively correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam emitting direction onto the eyeballs of said user,

a sound output portion,

a communication portion that inputs image information from the outside into said display portion and inputs sound information into said sound output portion,

a supporting portion which supports said display portion at its portion that is not in contact with said user, and

a face contact portion which is supported by said display portion and comes into contact with the face of said user,

wherein said communication portion has, when at least two sets of said image display devices are set in the vicinity of each other and are used, a switching mechanism of infrared lights having slightly different wavelengths.

75. An image display device according to claim 74,

5 wherein said face contact portion is provided in contact with the face sides of said user and sandwiches the face of said user, and

wherein said display portion is movable in accordance with the movement of the head of said user, a portion of said face contact portion being a point of support.

76. An image display device comprising:

10 a display portion that projects, via eyepiece optical systems which respectively correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam emitting direction onto the eyeballs of said user,

a sound output portion that outputs sound to the both ears of said user,

15 a voice input portion to which the voice of said user is inputted,

a supporting portion which supports said display portion at its portion that is not in contact with said user, and

a face contact portion which is supported by said display portion and comes into contact with the face of said user,

20 wherein said image display device being characterized in that it is provided, when at least two sets of said image display devices are set in the vicinity of each other and are used, with a switching portion that switches what kind of sound information is outputted from said sound output portion and with a switching portion that switches to which image display device is inputted voice information from said voice input portion.

25 77. An image display system according to claim 76,

wherein said face contact portion is provided in contact with the face sides of said user and sandwiches the face of said user, and

wherein said display portion is movable in accordance with the movement of the head of said user, a portion of said face contact portion being a point of support.

30 78. An image display device comprising:

a display portion that projects, via eyepiece optical systems which respectively correspond to each of the both eyes of a user, a light emitted from a two-dimensionally light emitting type photoelectric device which is perpendicular to the light beam emitting direction onto the eyeballs of said user,

35 a sound output portion that outputs sound to the both ears of said user,

a supporting portion which supports said display portion at its portion that is not

in contact with said user,

a face contact portion which is supported by said display portion and comes into contact with the face of said user, and

5 a switching portion that switches whether sound information from the outside is outputted by said sound output portion.

79. An image display system according to claim 78,

wherein said face contact portion is provided in contact with the face sides of said user and sandwiches the face of said user, and

10 wherein said display portion is movable in accordance with the movement of the head of said user, a portion of said face contact portion being a point of support.